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DEPARTMENT OF ART AND DESIGN

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TITLE	DATE	MEDIUM	SIZE

CORE
system

Adaptable Walls for Flexible Living

Support material for a visual
Master of Design thesis in Industrial Design

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August 1998

Abstract

This thesis proposes the design and application of a moveable wall system for residential applications. With the CORE system (coordinated and redefinable environments) homeowners could reconfigure the layout of their house as their needs change. Flexible/adaptable space increases the useability and value of a home.

Included in the report are several historical references outlining the need for more flexible housing. A written description of the design and illustrations of critical components explore how the system works. Practical technical features are explained and several environmental considerations are discussed.

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Introduction

As the size and make-up of a family changes over time there is a need for the domestic dwelling to accommodate these changes. There are many reasons for peoples changing needs. Families grow with the addition of children. In-laws frequently move into a house when they are suddenly alone. As children grow up and leave home their bedrooms either remain vacant or are often converted into a utility room. Statistics Canada shows that between 1971 and 1991 the number of children leaving home has increased by 35.1 percent (Statistics Canada, 1992). New interests and hobbies require task-specific rooms such as a home office or a sewing room. Some people are suddenly dependent on the use of a wheelchair but the layout of their house cannot accommodate this requirement. The concerns for housing flexibility are common to many cultures. In the early 70's, in France an increased interest was shown in houses that could accommodate the needs of disabled people due to the high cost of institutional health care (Architectural Design, 1974). These are just a few reasons the inflexibility of a traditional home fails to meet our changing needs. The importance of permanent housing is on the rise. In 1991, 72.9 percent of family households own their own home, an increase from 64.4 percent since 1971. (Statistics Canada, 1992)

CORE
system

Living in unaccomodating housing can be merely inconvenient or bring additional stress to family relationships. Renovations, if possible, can be disruptive and costly. If a house's inadequacies are extreme, moving may be the only alternative, pitching a family into debt and severing them from their community. There are alternatives to the above scenarios.

The availability of a practical movable wall system would facilitate an easy reconfiguration of house space to accommodate changing living requirements. Having recognized this need for a more flexible living environment, I have developed a system of movable interior walls which allows the home owner to reconfigure their living space. My proposed design "The CORE System", (coordinated and redefinable environments), attempts to address this problem.

Whenever homeowners wish to change the configuration of their home it can be a lengthy and expensive process. A movable wall system would allow a family to change the layout of the home quickly without additional cost. Their changing needs would be accordingly met.

Historical examples

Numerous researchers, architects and designers have, in recent housing history, proposed alternatives to the limitations of traditional housing.
In 1973 and 1974, Architectural Design Magazine published two articles featuring research in the current techniques and responses to flexible environments. In the past there have been various projects incorporating movable wall systems for residential applications. In the 1970's most of these projects focused on family dwellings in Europe. In France, Sweden, Germany, Netherlands, Switzerland and the UK there were different systems for creating flexible environments. However the partitions were crude and lacked proper electrical distribution. (Architectural Design, 1974)

Dutch architect, Gerrit Rietveld designed the Schroeder house with the help of his client ,Truus Schroeder-Schrader, in 1923-24. This house was innovative for several reasons. First, the house was a classic example of De Stijl style." This house is a volumetric composition of sliding and overlapping planes slotted into the coordinates of a three-dimensional grid, thus extending the possibilities explored in the painter Piet Mondrian's abstract use of colour and space." (Stevenson 1997) . Second, a series of sliding partitions that could divide the large room into two smaller rooms were incorporated into the design of the home (fig. 1).

This was an excellent system for dividing the larger rooms into two smaller spaces, however, the number of variations is limited since the placement of the sliding partitions could not be altered.

In 1972 French architect Jean Prouve, with the help of Sandor Majercsik, designed an exterior wall partition system known as S.I.R.H. This system used completely industrialized components manufactured in steel, plastic and aluminium. When the eight components were assembled, the room could change in size from 3.8 m to 7.6 m square. These rooms would connect around a central service duct. (Rabeneck et al.) (fig. 2)

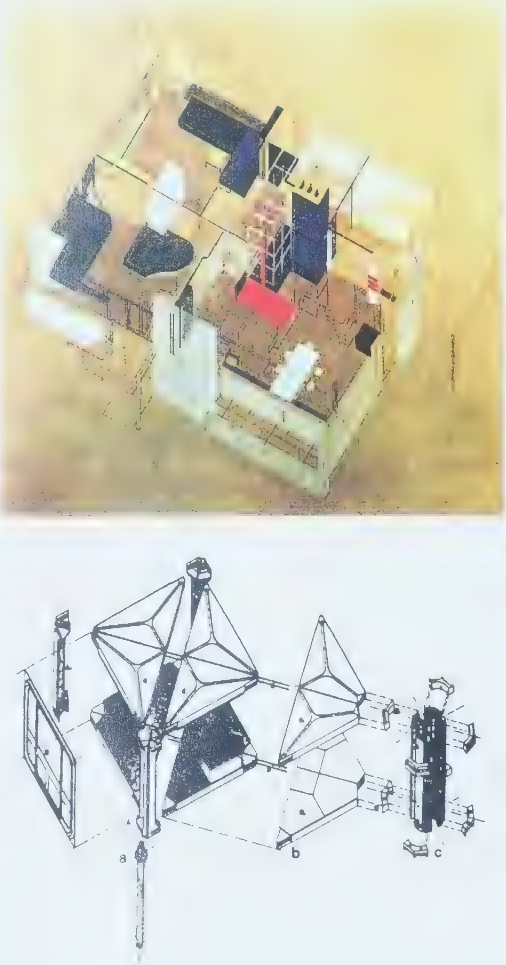

Fig. 1-2

Although this design was innovative, the flexibility in the design would be used only in the initial construction of the home. It would be more difficult to change the house configuration once the house was built, the average homeowner

would not be able to change the house layout. This system was designed to facilitate the construction industry, not meet the changing needs of the user.

In 1970 the Boro company in Sweden designed a moveable partition system made of a wooden subframe infilled with vinyl covered drywall. The panels were 600 mm wide, 2.5 m tall and weighed 39 kg. There were also smaller panels made so that other room sizes could be achieved. These partitions were secured by means of a friction fit. The panels would be joined together with splines that fit in grooves within the panels. (Rabeneck et al.)

The Boro partition wall approach is appealing since the homeowner can change the layout of the home as required, however the design does have some drawbacks. Since the panels are made with 12 mm thick drywall, inevitably they will be heavy. The company advertised the changing of the room as a family activity and this is necessary since it requires a few people to manage the weight of the panels.

The lack of a grid system may make it difficult to rationalize wall placement and it may be problematic to get all of the panels to line up and connect to each other.

In recent years there has been a considerable amount of research done here in Canada on Flex Housing (homes that can be easily adapted for new living requirements). An adaptable housing design competition was sponsored by the CMHC in January of 1996. These housing systems are somewhat limited their approach to flexible housing. It allows for the home to be designed with change in mind for the future. When change in the home is required, a contractor is required to make the desired changes. Although there have been many advances in flexible housing design, I feel the proposals don't go far enough. I believe the concept can be pushed further to eliminate the need for contractors and involve the home owner more directly.

Four Methods to Improve Accommodation

There are four different approaches to reconfigure the home, adaptable, add on, add in and flexible.

The *adaptable housing approach* requires that the rooms of the house be designed as generically as possible to deny a specific function of the rooms. Built in furniture is not included in the rooms since the furniture can dictate the function of the room. The homeowner can decide the layout of the house. This approach may be the most successful for the long term because no new renovations are required when the homeowner requires a change. (Rabeneck et al.)

This approach requires the design of the home to be planned in the initial stages. Once the home is built the number of room variations is limited and the size of the rooms cannot be altered. The costs of building such a home is on par with traditional homes, having function specific rooms.

The *add-on approach* requires building on to the home to increase the available living space. This approach has existed for along time simply because it is an expedient alternative to moving. Usually when the homeowner wishes to increase their living space the infrastructure of the home, bathroom and kitchen and services are paid for. The extension is relatively less expensive since the extension is usually just larger rooms.

The *add-in approach* is similar to the add-on method of gaining more living space, however the extension is done within the existing space in the house. This is usually an attic conversion. As with the previous method most of the infrastructure is in place therefore the conversion cost is at a minimum. This approach is not feasible for all houses. The shape and height of the roof may prevent such a modification, however, it is possible to raise the roof if there is no adjacent land available for an *add-on*.

The *flexible approach* allows the homeowner to move the walls in order to suit their needs. Each floor of the house is a large unobstructed room in which the homeowner is free to create any type of layout. The partitions can be a low technology solution using materials that are inexpensive and easy to work with or they can be more complex sheet metal clad partitions that are currently being used in office buildings.

The authors of the flex-housing study do not favour the flexible housing approach due to the inevitable obsolescence of the hardware, however they do state that if the choice to use flexible walls has to be made, the partition system should be technologically simple using materials that are readily available. (Rabeneck et al.)

Traditional building techniques

Popularly used building techniques rely in fixed walls to be permanently situated. The room configuration is determined at the beginning of construction and the house normally remains the same despite a family's frequent changes in lifestyles. Rooms can be reconfigured in a traditional house, however it requires substantial planning and usually professional trades people, framers, drywall installers, electricians and painters. These trades are expensive even if the home owner requires only a modest change.

Houses are assembled in a specific manner. A foundation is cast or built to which a wooden floor is constructed and perimeter walls are attached. The exterior side of the perimeter walls are sheathed (covered) with plywood, or more recently, oriented strand board (OSB) (fig. 3) and then one of a number of exterior treatment are added. The interior walls are then erected with 2x4 or 2x6 lumber or more recently sheet metal studs. The vertical framing members are placed every 16 inches

on centre over the length of an external wall. The electrical, plumbing, communication and home entertainment components are installed before the walls are covered with the drywall sheets and painted. This technique was developed in Chicago around 1833 and has largely remained the standard since (Brand, 1994).

Fig. 3

The CORE System

I have designed and constructed a movable wall system which allows the homeowner to easily move the walls in the home so that the layout of the rooms can be changed at any given time. The wall panels can be placed and fastened in a 3-D grid which is incorporated into the floor and ceiling. The doors which provide access to the rooms can be placed almost anywhere within the grid system. This design incorporates electrical outlets on each side of the wall at approximately eight foot intervals.

The basic movable wall system contains five separate components:

- A floor and ceiling index plate, which secures the panel braces to the floor and ceiling
- An upper and lower panel brace, that securely holds the wall panels in place
- A wall panel which defines the space, There are different versions of these components for the various functions of the walls, (e.g. door sections)
- A post, which connects two wall panels or forms the corner of a room when two wall sections intersect perpendicular to each other

These components are placed along a grid system to create the walls which define the layout of the house.

It is during the construction stage that the floor and ceiling index plates are installed by the contractor. Once the homeowner wishes to place the walls in the new location they would slide the wall panel into place with the upper and lower panel braces attached to the wall panel that is being moved. One person can move the wall panels , however it is easier if two people move the panels. When the wall is in place the panel braces are screwed to the index plates. The posts can be located between the panels when all the walls are secured in place, completing the wall.

Panel Index

Perimeter walls are constructed in the usual manner using steel studs and drywall. These walls are permanently secured and are the structural enclosures of the house. The CORE system is attached to the perimeter wall by connecting it to the floor and ceiling index plates with machine screws.

Starting at a corner of the house interior, 2 1/4 inches from each wall, is a floor and ceiling index. There are index plates placed every 52 1/2 inches on centre, along the perimeter of the exterior wall. It is essential that the exterior walls of the house conform to the grid system in order for the walls to align properly.

Index plates are permanently screwed in place on the floor and ceiling every 52 1/2 inches in order to accommodate any future wall location changes. These are the only parts of the wall system that remain permanently in place when the walls are being reconfigured. The floor and ceiling index plates are small anchor receptacles made of 14 gauge sheet steel. These anchor points are recessed into the floor by 1/4 inch and are three inches in diameter. The metal discs have 9 holes drilled into them at specific locations. Four threaded holes are placed at 90 degree intervals to receive panel braces. Four additional holes are drilled midway between threaded holes and are countersunk to receive the flat head wood screws which secure the indexes to the floor. The centre hole is also threaded to receive a decorative cover to hide the floor index plate. The floor has to be hard wood or a similar material so that the index plates can be recessed below the surface. This is necessary in order to cover the index plates with the similar floor material. The ceiling plates are painted the same colour as the ceiling. These plates are surface mounted since there is no practical reasons for inserting them into the surface of the ceiling. (figs.4-5)

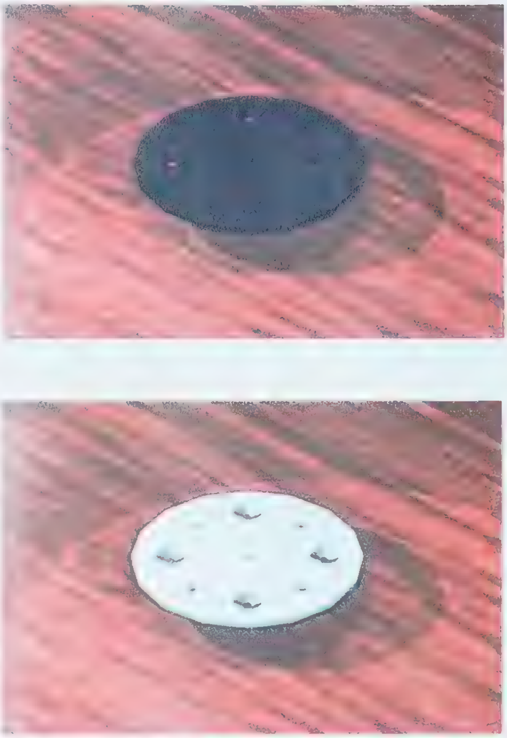

Fig. 4-5

Panel Braces

Connected to these index plates at the floor and ceiling level are the panel braces. There are three basic components to the panel brace. The first is a 1/16 inch thick 6" by 52" length of sheet metal which two base boards are attached to. The baseboards are made of a recycled paper product or MDF and measures 48" x 3 1/2" x 3/4" The upper panel brace, attached to the ceiling index plates, has both baseboards permanently attached to the sheet metal. The lower panel brace has one baseboard which is fixed and the other one that is hinged to allow the wall panels to fit easily inside. Once the wall panel is located, the baseboard is closed and screwed in place. A single machine screw at the end of each panel brace securely holds the support to the floor index plate. (fig. 6-7)

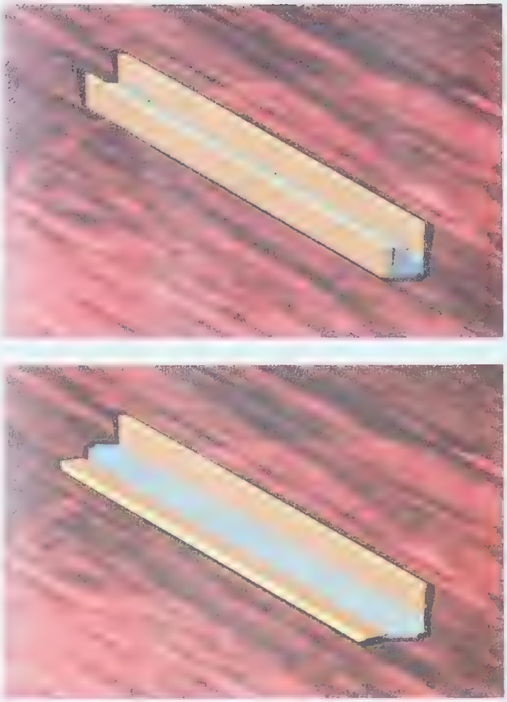

Fig. 6-7

Wall Panels

The wall panels and their location define space. These panels are locked in place by the panel braces. The wall panel is a torsion box construction which is similar to a hollow core. A lightweight frame is constructed with lattice glued inside the frame to support the external skin material. There is insulation inside the wall panels to deaden sound transmission. The wall panels measure 48" x 96" x 4 1/2" (fig. 8)

Fig. 8

Door Sections

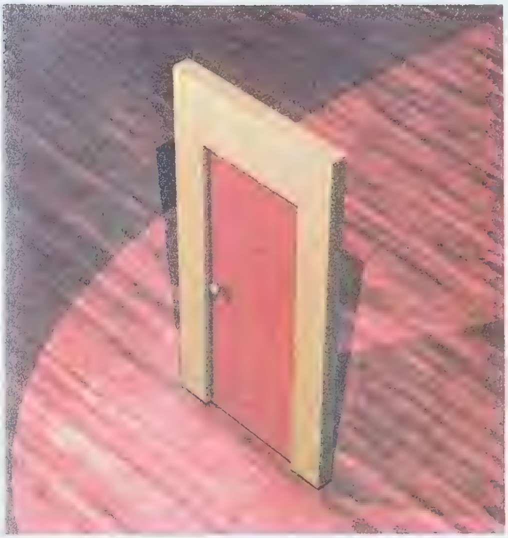
Fig. 9

As the rooms are defined door sections are required for access. (fig.8) A standard ready made door is fitted into the standard movable wall section. The wall section is constructed to securely hold the door frame. Each door section is symmetrical so that the direction the door opens can be easily changed by simply reversing the placement of the wall/door section. If the homeowner wishes to change the direction the door opens it is possible to flip the door end for end so that the door will open in the opposite direction. To facilitate this, the door knobs in this system will be mounted half way up the door and not slightly below the midway point as is normally done. This is necessary to prevent two different door knob heights. These door sections fit onto the floor and ceiling braces which holds the door securely.

Posts

A post section fits between each panel and either connects the panels, defines the corners or ends a length of wall (figs. 10). These posts are 4 1/2" x 4 1/2" x 96" and are made of lightweight materials such as Gridcore or Miracle board (figs. 11-12). These posts are not structural and therefore can be made of any lightweight material.

Fig. 11

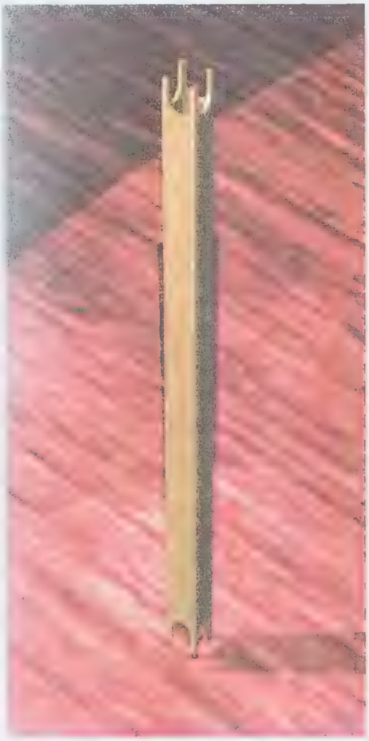
Fig. 10

Construction concerns

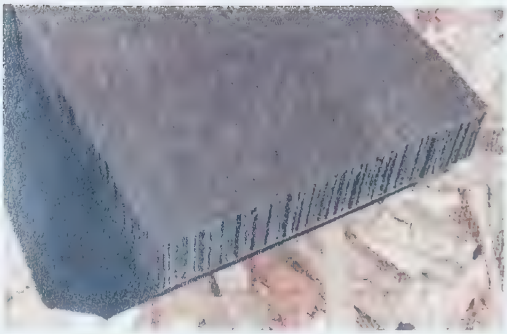

Fig. 12

A house designed to receive the CORE system should be constructed using engineered joists to free the house space of load bearing walls and posts to achieve its optimal potential. If a bathroom is placed in the centre of the floor space the bathroom walls can be used as load bearing walls thus eliminating the need for longspan joists. The bathroom can also be placed next to a perimeter wall for greater spacial flexibility.

When the house is designed, the exterior windows are placed within the grid system to prevent them from intersecting a window. The window size cannot be larger than four feet wide unless it can be predetermined that it will not be intersected by a CORE wall. Otherwise, there are no limitations to the number of windows desired as long as there is a section of wall where the CORE system can intersect the perimeter wall. The placement of exterior doors must also relate to the grid system.

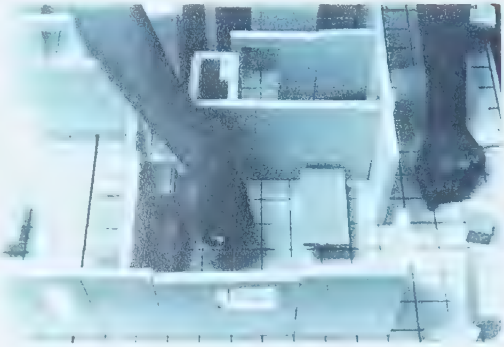

Fig. 13-14

Design system

A computerized system or a modelling kit can be used to assist in the designing of the floor plan before laying out the interior walls. It would be difficult to imagine the layout of the rooms without the aid of a visualization tool. It could be possible, with the use of computers to create a virtual tour of the design the home owner wishes to realize. A simple tool could be developed using paper cutouts or any other suitable materials to design an architectural floor plan. Bruce Bentz's interior modelling kit would be ideal for this application. This kit was developed in the early 1980's as a design tool made of foam-core to help homeowners visualize the space in their proposed house design. (Bentz, 1985)

When the home owner wishes to reconfigure their home, they can use this tool to help visualize a new floor plan before beginning to move the actual walls to a new location. (fig. 13-14)

Utilities

Electrical System

Each lower panel brace has one electrical receptacle which is attached to the unhinged baseboard . The electrical box has a male and female plug which runs to the end of the panel brace. As the panel braces are laid along the floor the male and female plugs are connected. The string of panel braces are connected to the perimeter wall outlet which supplies the wall with electricity. There are left hand and right hand panel braces which allow both sides of the wall to have a receptacle. Each alternating baseboard will have a receptacle which allows an electrical duplex every eight feet.

In order to prevent plugging one power supply into another there are male and female electrical plugs which can only be inserted into a safe connection as with a typical electrical cord. When all the panel braces are screwed in place along the floor and ceiling and the electrical system is connected, the plugs are neatly hidden inside the panel brace section. The electrical components are off the shelf equipment in order to keep costs to a minimum. These components could also be salvaged if the wall system is recycled for parts.

Lighting

Since the walls are movable it would be difficult to wire the light switches in the traditional manner. An appropriate solution would be a low voltage RF (radio frequency) system in which the light switches can be individually programmed to control any light within the house. All the switches are radio frequency transmitters which sends a signal to a transceiver. The transceiver can handle up to 16 separate channels. A channel is different from a light switch since several lights can be programmed to one channel. A receiver is wired to the light and it is this device which turns the light on or off. Each receiver is assigned an identification number and through this ID number each channel can be controlled from anywhere in the house. The switch is a surface mount unit which can be attached to the wall by screws or velcro. By using this system it is possible to reconfigure the lighting system each time a wall has been moved to a new location. Small sections of track lighting can be placed inside each grid area. This allows for a considerable number of lighting possibilities. Currently there are several companies manufacturing these home automation systems.

Plumbing

Bathrooms and kitchens will remain in a fixed location due to the complexity of plumbing. Kitchens should be located on perimeter walls so that they can support the standard kitchen cabinets. The walls of these spaces should be fixed because of the number of related devices that must be securely anchored to them externally or internally.

In the basement mechanical room, furnace, hot water tanks, and all other utilities are located. The walls of this utility room are permanently fixed and can support the elements of a movable wall system.

Heating and Cooling System

Heating and cooling can be handled either by radiant floor method or by forced air. Radiant floor heating requires a length of flexible hose which is systematically placed in the floor. The hose is covered with concrete or plywood and hot water is forced through the hose heating the floor and subsequently the house. This system will eliminate the need for heating vents and ducts. The only drawback to radiant floor heating is the recovery time to reheat a room when it becomes cold.

With the forced air method all ductwork can be placed between the floor joists with the vents placed within the four foot grid system without interrupting the free placement of the walls. It is important to have variable control vents so that the hot or cold air flow can be adjusted. With the forced air system the movable walls could affect the delicate balance of proper air flow therefore the radiant floor system would be better suited for a house using the CORE system to ensure a constant temperature throughout the home.

Telecommunications

Julian Berdych, Senior Systems Analyst at Ericsson Research in Montreal, has said that "cellular technology is advancing beyond regular telephone technology." It is clear that the next phase of residential telephone systems will be very similar to the common home portable phone, however, it will be a cellular phone using the existing outdoor system. Like the present wireless home phones there will be a base station that will transmit to the portable phone. While the phone is being used in the residence the phone will communicate with the base station. When the phone is moved from the house the base station will automatically "hand off" the call to the existing cellular system until the phone arrives at the work place where the phone call will be transferred to the base station at the place of employment. This system is being developed by the cellular providers to free up the number of channels each cell has in a given area.

This new system would be used to solve the problem of running phone lines to rooms in a flexible house.

Wireless television cable would be the best solution for connecting the television set with the seemingly endless array of possible channels. This works by using a transmitter which is hard wired to the cable television signal. The transmitter sends a signal to a receiver which is attached to the television set.

Building code requirements

Room and Space Dimensions

In order for the CORE system to be manufacturable and not merely a theoretical project it is essential that the system meets the required building code. For this preliminary stage of the project I have chosen to adhere to the Alberta Building Code (ABC). Alister Cockburn of Alister Cockburn Architects in Edmonton has said that the National Building Code is not as strict as the Alberta Building code. Using a more stringent set of rules as a minimum standard means regulatory acceptance across Canada.

Since the exterior walls of the dwelling are designed to receive the CORE system would be constructed in a standard presently accepted by the ABC, I have decided to focus only on the codes that pertain to the interior partitions.

Room	Total area size	Minimum dimension
Living room	13.5m^2 or 12 ■	3m^2 or 3 ■
Living room in combination (2 persons max)	11m^2 or 10 ■	n/a
Dining room	7m^2 or 6 ■	2.3m^2 or 2 ■
Dining room in combination with other room	3.5m^2 or 3 ■	2.3m^2 or 2 ■
Master bedroom (no less than 1 bedroom dwelling)	9.8m^2 or 9 ■	2.7m^2 or 3 ■
Bedroom	7m^2 or 6 ■	2m^2 or 2 ■
Kitchen	4.2m^2 or 4 ■	n/a

■ = 1 Grid on the floor

Fig. 14

When architects design a home, they are required to dimension the various rooms in the home to meet the minimum sizes allowed by the local building code. It is the architect who has to adhere to the codes and not the home owner when the home is constructed with fixed walls. With the CORE system, the onus is on the homeowner who must meet the requirements of the code. A simple chart would be included with the CORE system that would inform the homeowner of the minimum allowable number of grid sections for any given room. (fig. 14)

The ABC has set guidelines for Bathroom dimensions, however since these rooms are fixed in location with permanent walls, the architect would adhere to the specific code for bathrooms.

The width of the hallways, as per the ABC shall be at least 860 mm which The CORE system exceeds this minimum by 340 mm.

Doors

"A door shall be provided at each entrance to a dwelling unit, to each room containing a water closet and to each room containing a boiler or furnace within a dwelling unit."(Alberta Building Code)

As stated in the ABC the only doors that would be permanently fixed are the three mentioned above.

The allowable door size for a room located off a hallway or a walk in closet must not to be smaller than 610 mm. The CORE system uses doors that are 760 mm wide.

Interior Wall and Ceiling Finishes

The CORE system meets the ABC standard when hard board is used for the cladding for the panel sections in the prototype, however in order to pass the requirements for the thickness of hardboard (3 mm) it is required that the panel have continuous support on the backside of the material. This support could be a honey comb-like cardboard material that is found inside hollow core doors.

Electrical Facilities

The ABC requires that the kitchens, bedrooms, living rooms, utility rooms, laundry rooms, dining rooms, bathrooms, water-closet rooms, vestibules and hall ways shall have a lighting outlet controlled by a light switch. This regulation can be met using the wireless light switch as described earlier.

Environmental Issues

As our natural resources are being depleted daily, it is our responsibility as designers to use alternative methods and materials to ensure the least environmental impact. The CORE system was designed and assembled with this in mind. Most of the parts used are off the shelf and are easily available. There are few non-renewable resources used in this project. All of the wood components are made from by-products of the forest industry. This discussion is expanded in Appendix A.

Conclusion

In the past, people usually designed and built their own dwellings with the help of their family and friends. They had the experience and knowledge to build the structure using materials that were available locally. This may still happen when one is constructing a recreational home, however, this rarely happens in a residential area. An architect or developer designs a home with some input from the client and the contractors build the structure. Today there is often little contact between the end user and the ones who build the house. (Papanek, 1995)

Most people are aware of their housing needs and should be involved in the design process. It is important to keep in mind that with this wall system the house is always evolving and therefore a constant work in progress, meeting the needs of the homeowner. The end user, over a period of time, can experiment with various solutions, each can be optimum for their current needs. The CORE system can allow the end user to experiment, change and improve on the house configuration and with very little invested in money or time. In a study relating to user choice in France, prospective occupants had a choice of ten different possible layouts. When the apartments were rented none of the prepared plans were chosen. The sociologist associated with the project said the tenants learned quickly how to design their personal spaces on grid paper and preferred to do this. (Rabeneck et al.)

In an article published in 1974, the authors state that the occupants of the apartment with the movable wall system are reassured that their plan is always reversible if they are unhappy with the room layout. They felt there was no penalty for changing the walls if the floor plan was unsatisfactory. This makes this approach to housing appealing to so many people. The users of this system do not have to make any final commitments to the layout. There is peace of mind knowing that nothing is final. (Rabeneck et al.)

The concept of movable walls has been around for some time, however the technology and costs have been keeping it from becoming a standard in our homes. Previously the flexibility of the walls has been somewhat limited. There is justifiable concern about the longevity of the moveable wall systems, however if the system is simple in its design then there is no reason why this system couldn't be successful.

Although the homeowner can change the floor plan of the rooms many times, I think it is fair to assume that the user would not move the walls very often. However, when new space needs require changes, it is much easier to reconfigure the rooms than to move or renovate. I believe the climate is right for adaptable housing and I hope to make a contribution to its further development.

Afterword

During my work on this project I have made numerous personal discoveries relating to housing accommodations. My CORE proposal suggests a possible solution to the provision of more personal choice through a simple, flexible, moveable, modular wall system.

I am comfortable with the present design of the system. But even at this stage I can envision further developments and refinements. I look forward to the opportunity to continue my research with a view to the fabrication of a workable prototype for testing.

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Appendex A

In the early 1990's a new philosophy in industrial design began to emerge. This approach was called Design for disassembly (DFD). It is a way to design objects so that they can be easily disassembled and recycled or repaired. (Papanek, 1995) At present most manufactured products are not designed this way. Automotive parts are an example. When the starter motor or alternator fails to function it is necessary to replace the entire unit as opposed to changing a few small parts inside. Ideally the faulty unit is sent to be reconditioned finding its way into another car instead of creating a surplus of extra parts that will soon be obsolete.

Gluing, welding and soldering are fastening techniques that are very difficult to disassemble. (Papanek 1995) Usually the parts are destroyed in the process of removing the components. It makes more sense to use mechanical fasteners that can be easily removed and replaced if the fasteners are damaged due to corrosion or faulty tools. In the early 20th century most of the automobiles were designed to be repaired. (Papanek 1995) Today it is easier to replace the faulty part The ability to disassemble automobiles makes it easier and faster to repair them when things go wrong. Some car manufactures are currently gluing door hinges on American cars. This is an impressive feat in engineering and adhesive technology. However, when a car is being repaired after an accident it is very difficult to get the door to fit properly.

The Aeron chair by Herman Miller Office Furniture has been designed for disassembly. When a part in the chair breaks a representative from the factory can replace that part no matter how small or internally located the part is.

BMW is leading the way in DFD manufacturing. The German government has legislated that the car manufacturers of Germany, Mercedes Benz, Volkswagen, BMW,etc. will be responsible for the recycling of the cars they produce. Therefore, it stands to reason that the automobile industry take drastic steps to simplify this process. (Papanek, 1995)

Design for demolition is the present practice in housing construction today. When a building has out lived its usefulness the building is usually destroyed with the remains taken to the closest landfill site. The second largest portion of landfill waste disposal is taken up by building debris, according to a definitive study. (Brand, 1994)

New homes are built everyday with very little regard for the environment. Lumber is used to frame the homes and when the house is renovated the material that is removed from the home usually ends up as waste. There is clearly a need to develop new building techniques using recycled materials to preserve our natural resources. Over 120 million hectares of the Earth's forests have been eliminated in the past twenty years. 17 million hectors have been destroyed in 1991 alone, the

largest rate of reduction in history (Hawken 1993).

Most materials required to build a house are common sizes. Sheet material such as plywood, OSB, gyp rock all are available in four by eight foot sizes. Wood and steel joists are commercially available in two feet increments. Large amounts of framing materials can be conserved by framing on 24 inch centres. (Fisher, 1993)

There have been new developments in demountable walls made with steel studs and vinyl coated dry wall board, however these systems seem to require the expertise of a drywall installer. Dry wall boards are made of plaster and therefore rather fragile. The walls can be dismounted and reassembled only a few times before there has been enough damage to render the parts useless. This method is not a totally viable option for the end user. The CORE system wall panels would be made entirely of pulp products from recycled paper. When the walls are no longer being used the panels can be easily recycled back into a paper product.

Some remarkable efforts have been made in recycling. A prototype car was developed in 1941 by Ford that had a soybean plastic body and tires made of goldenrod. (Hawken 1993) If in 1941 it was possible to make major components of an automoble biodegradable clearly it is possible to do the same with housing components.

Technical Drawings

Index Plate	Isometric and Dimensioned	Page 27
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Panel Brace	Dimensioned	Page 29
Post	Isometric and Dimensioned	Page 30
Door Panel	Isometric	Page 31
Door Panel	Dimensioned	Page 32
Wall Panel	Isometric	Page 33
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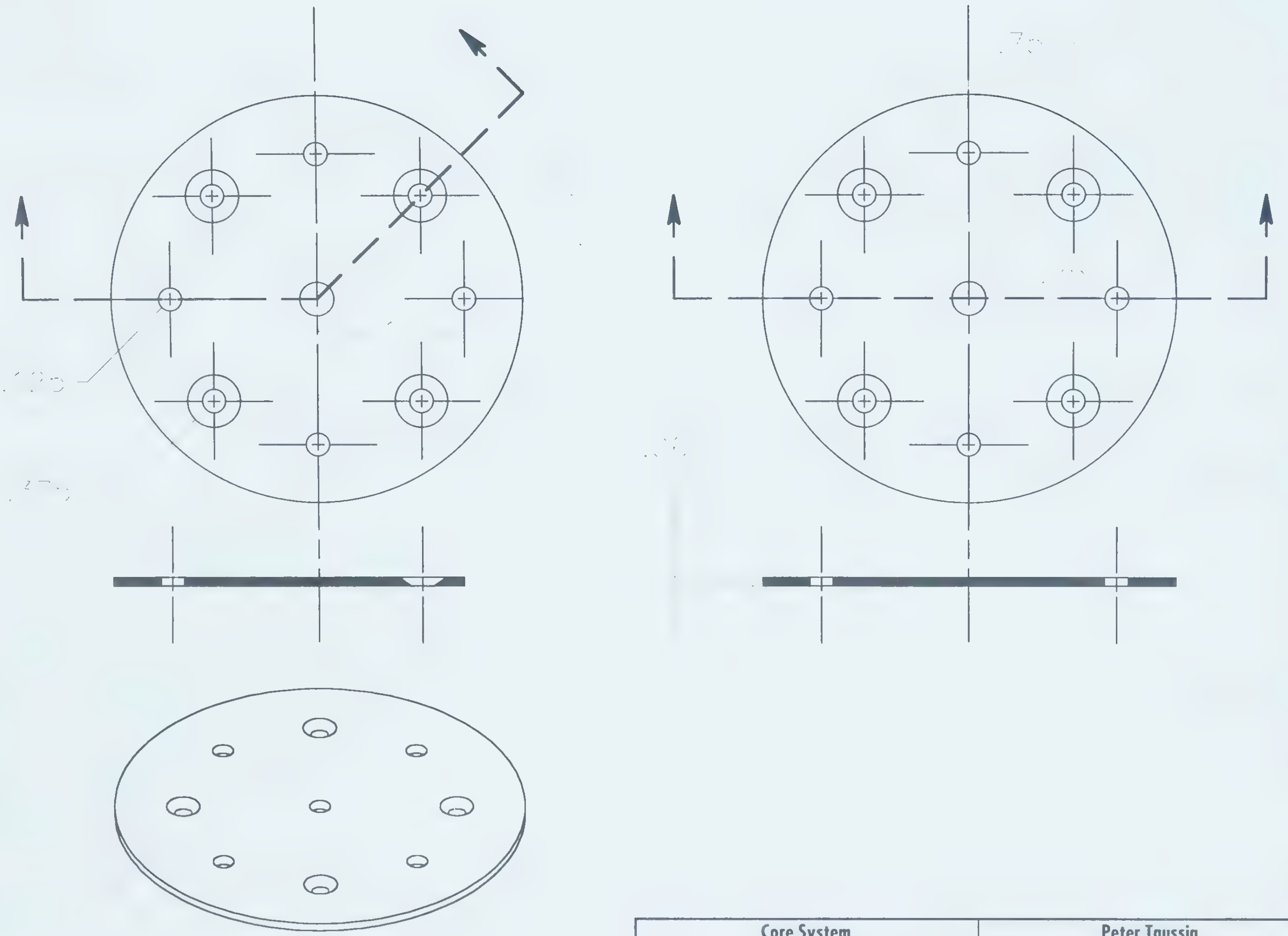
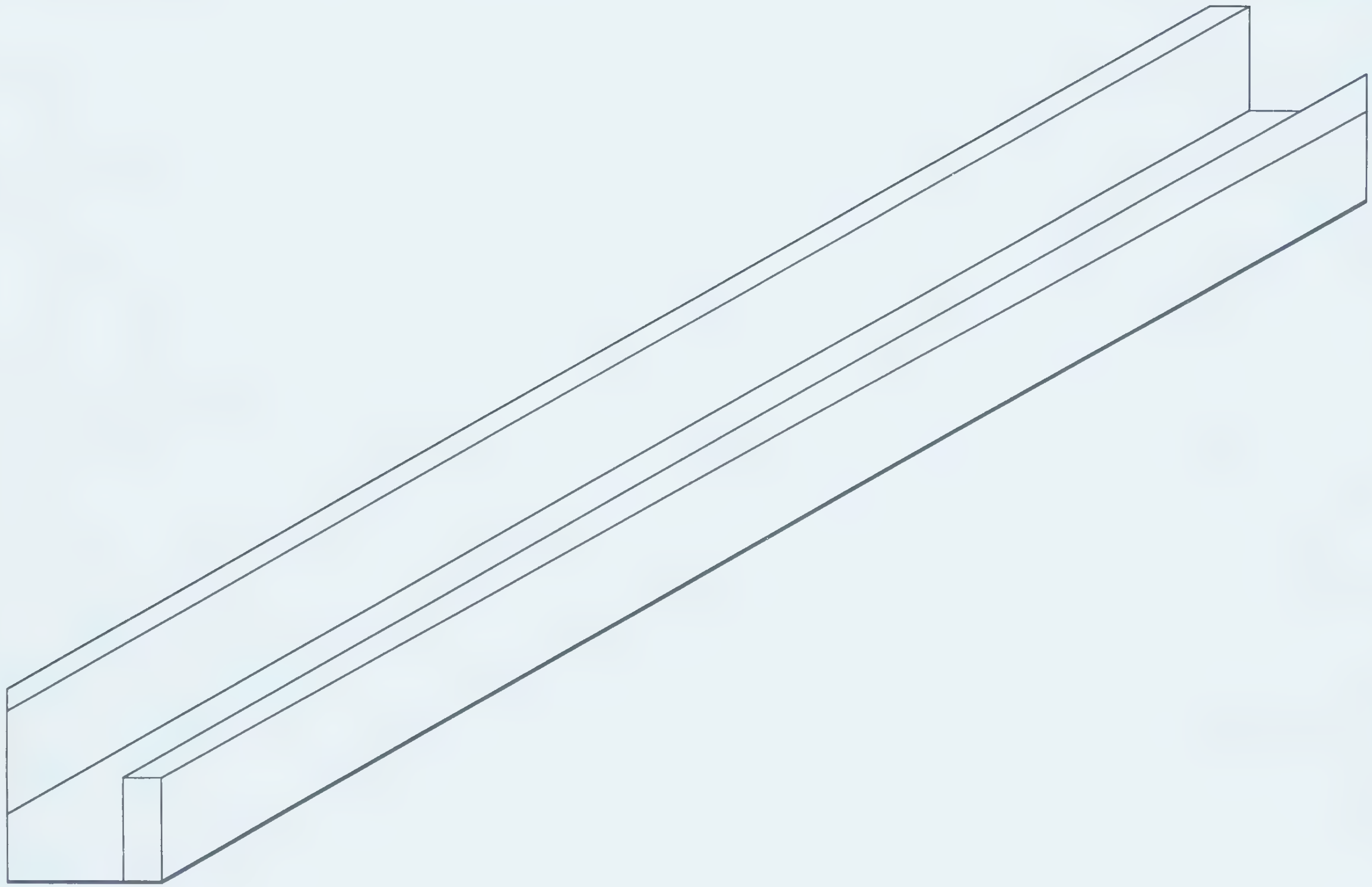
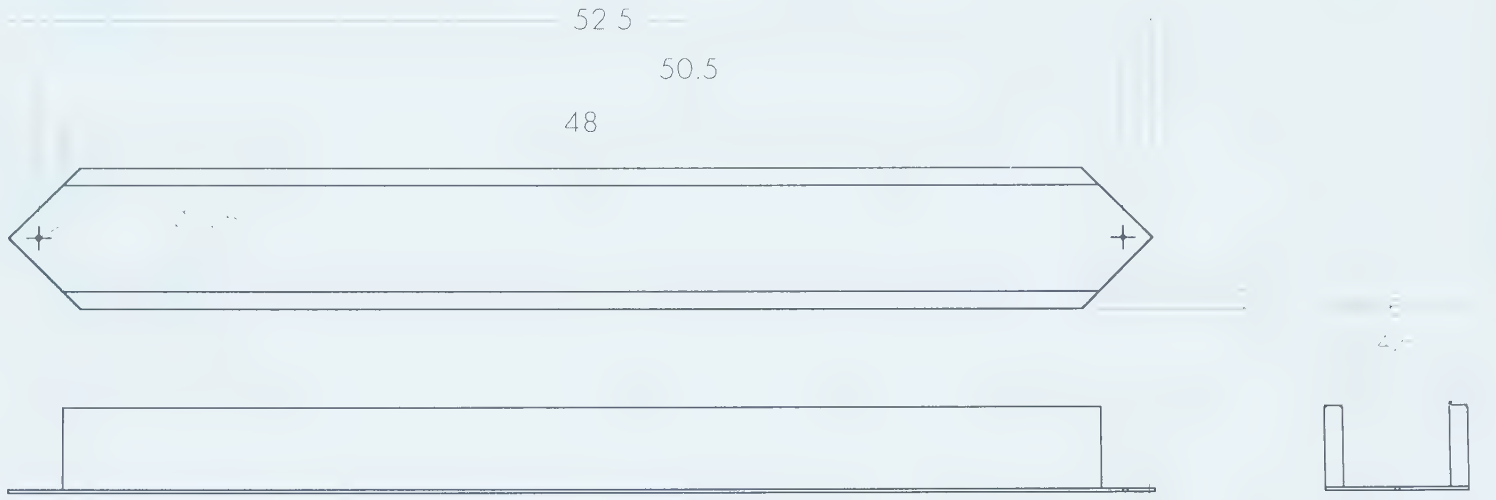
Wall Panel	Dimensioned	Page 36



Core System	Peter Taussig
University of Alberta	August 1998



Core System	Peter Taussig
Panel Brace Isometric	August 1998



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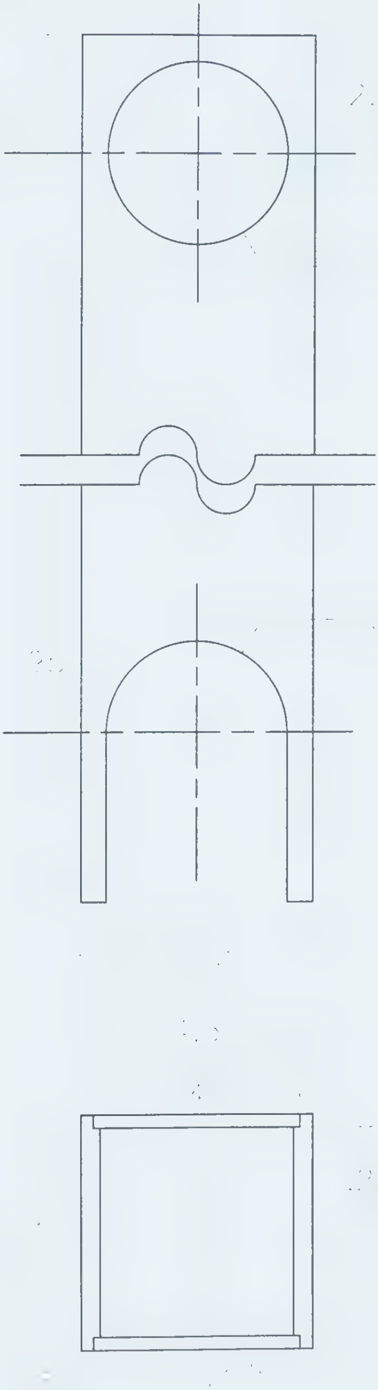
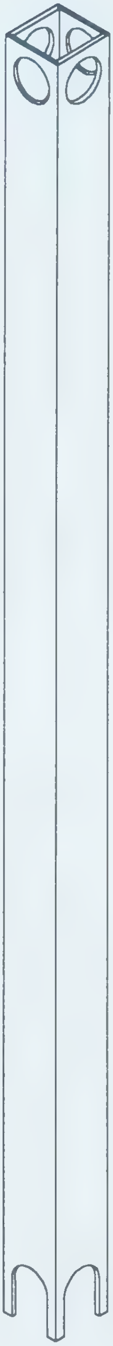
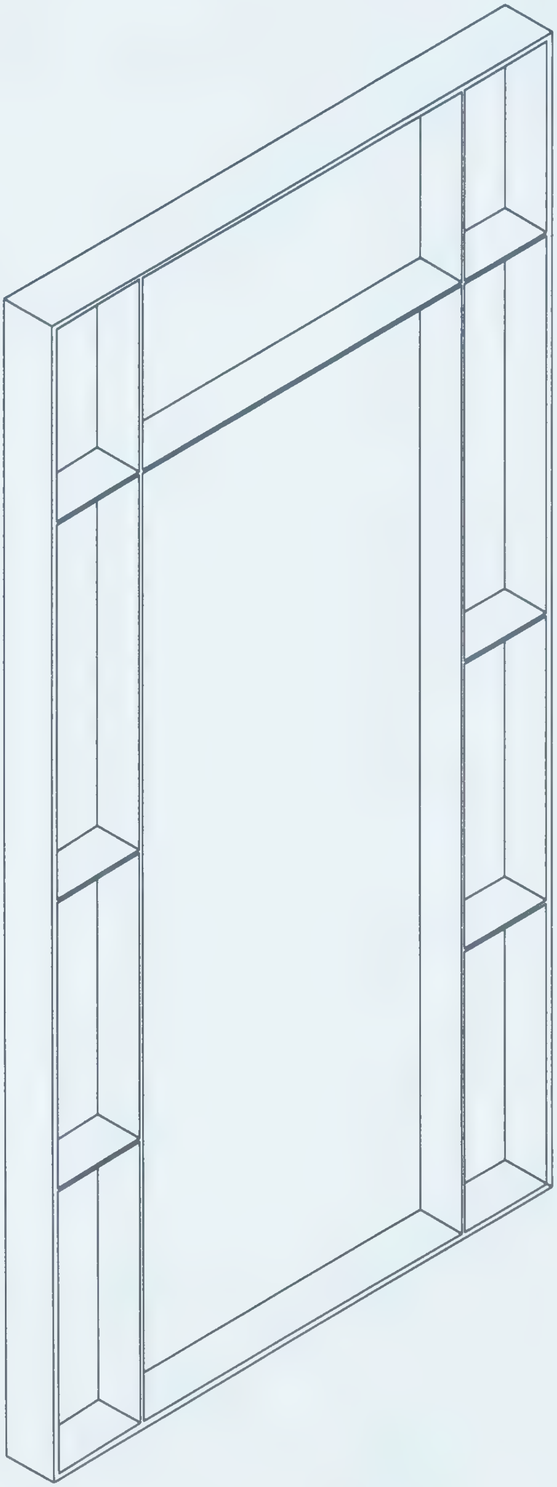
Panel Brace	August 1998

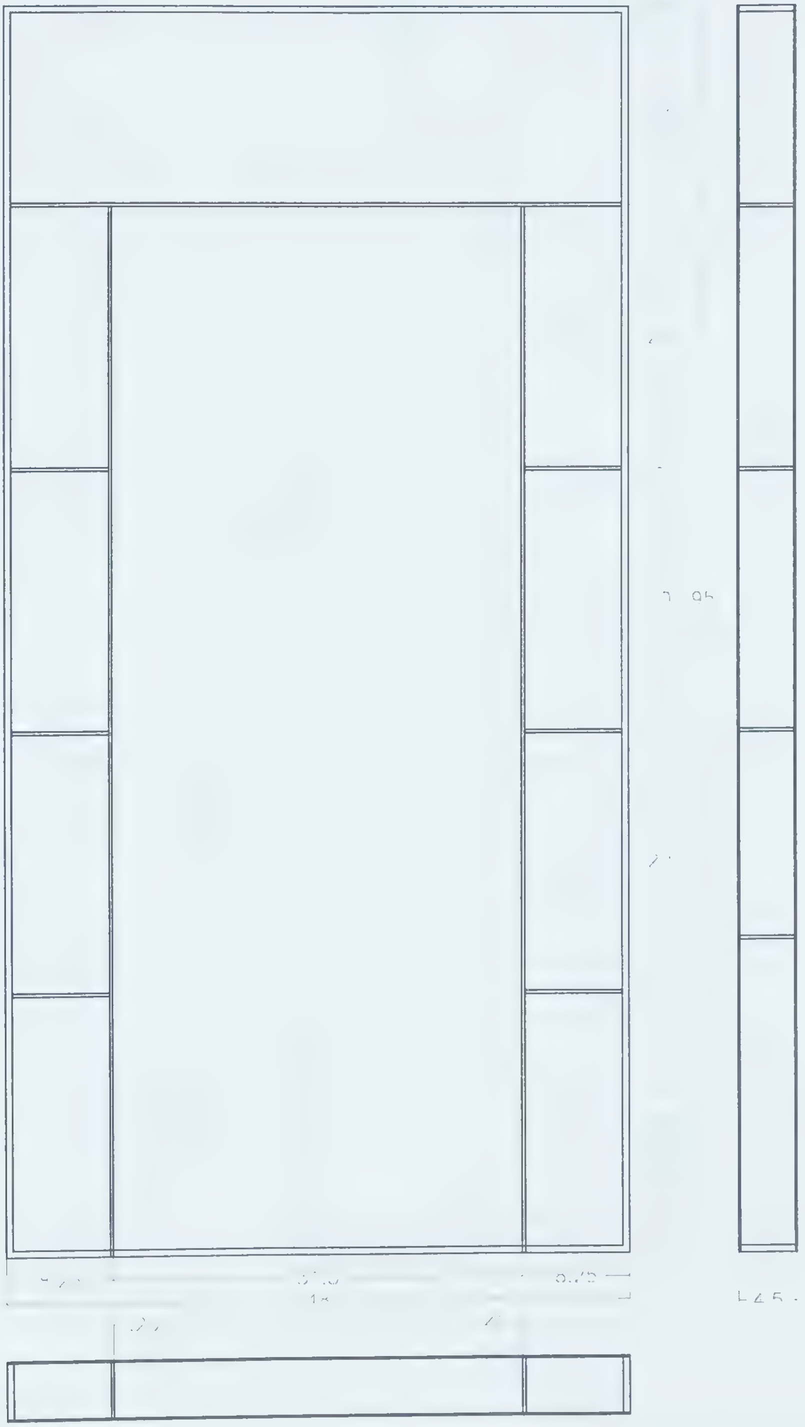




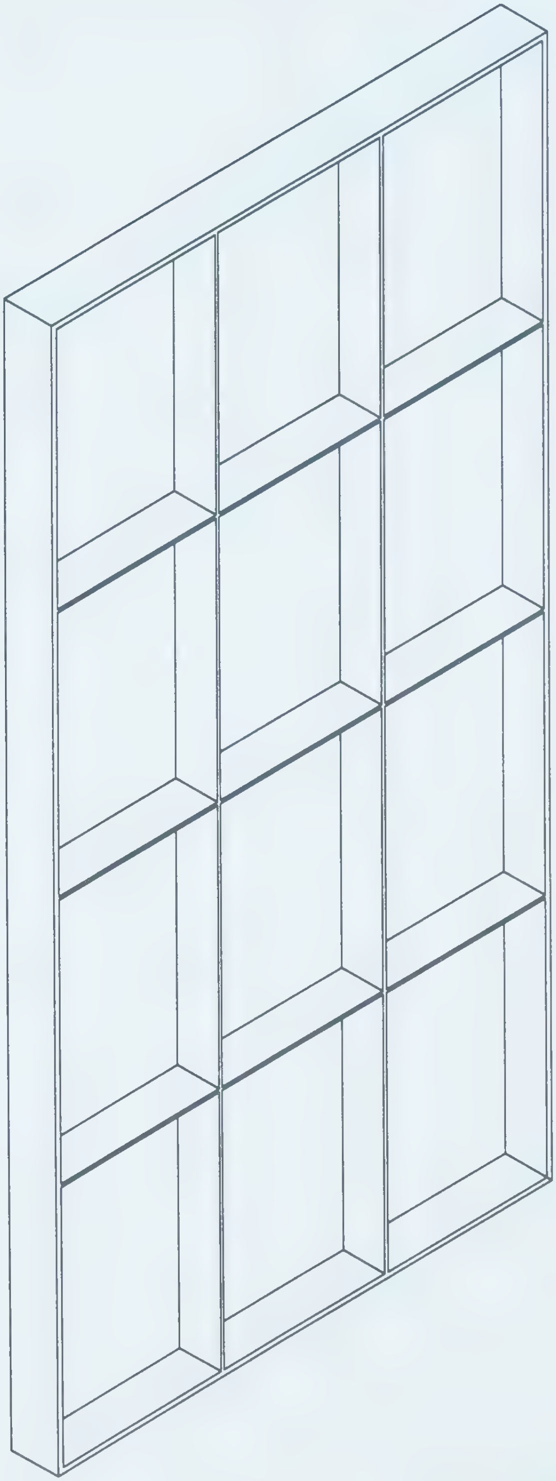
Core System	Peter Taussig
Post	August 1998



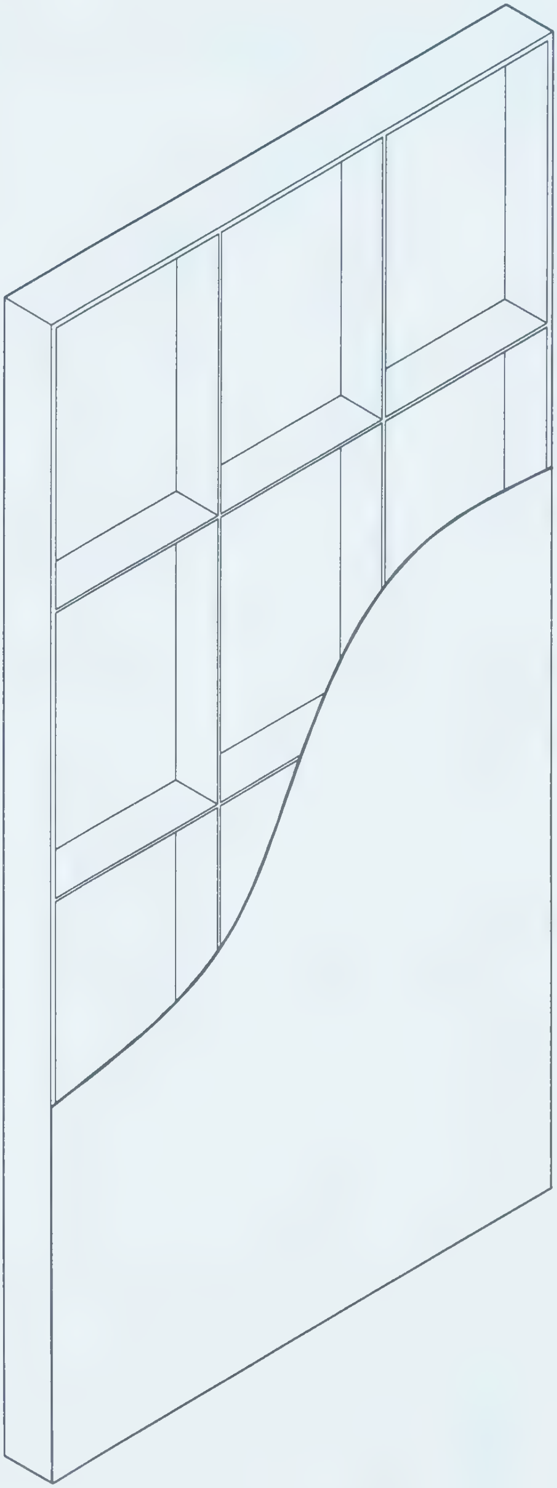
Core System	Peter Taussig
Door Panel Isometric	August 1998



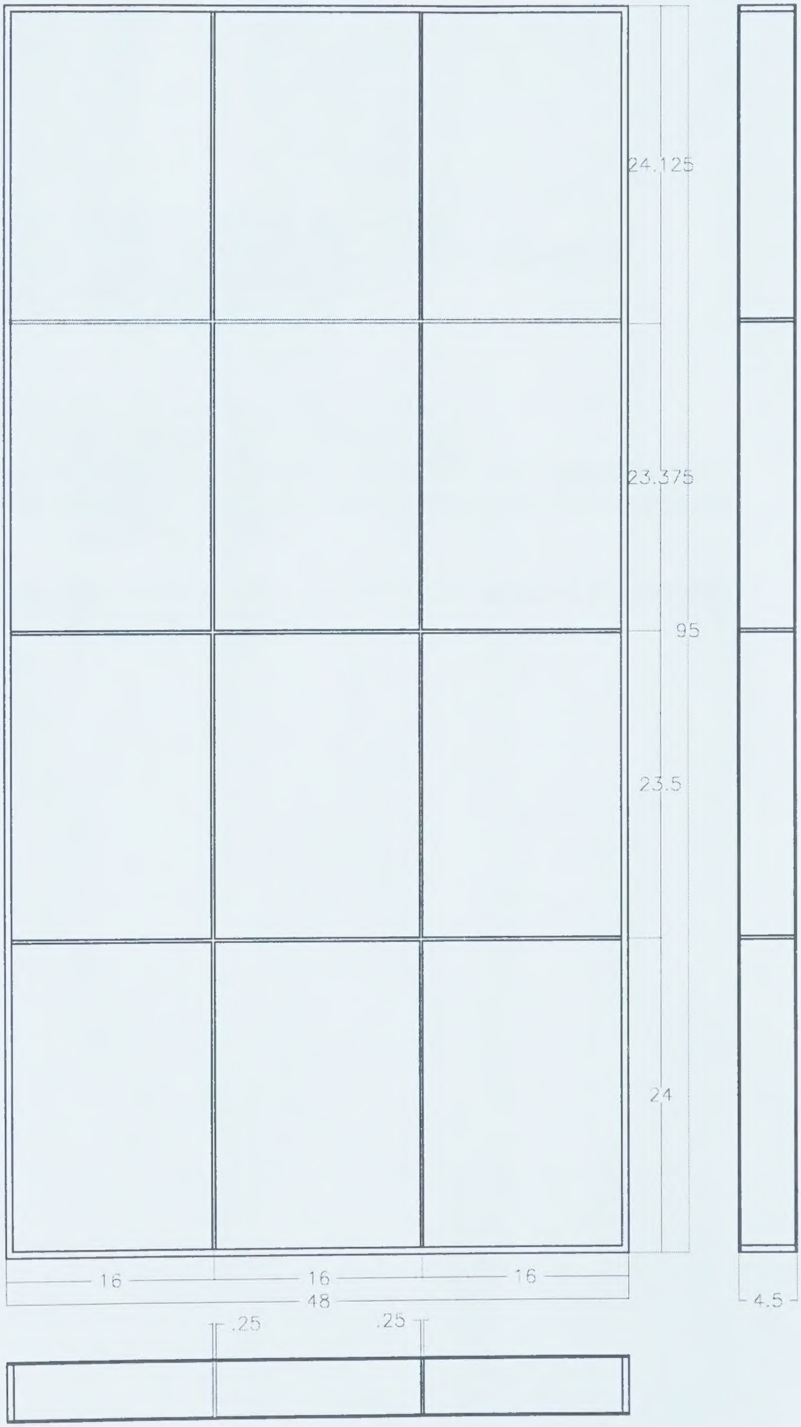
Core System	Peter Taussig
Door Panel	August 1998



Core System	Peter Taussig
Panel Brace	August 1998



Core System	Peter Taussig
Panel Isometric	August 1998



Core System	**Peter Taussig**
Panel	**August 1998**

Slide List

Row 1

- Slide 1: Full view of CORE system prototype
- Slide 2: Wall panels defining possible rooms configuration
- Slide 3: Door panel with open door
- Slide 4: Detail of door jam

Row 2

- Slide 1: Detail of post at the floor junction
- Slide 2: Detail of post at the ceiling junction
- Slide 3: Detail of index plate connection with panel brace (door panel)
- Slide 4: Detail of index plate connection with panel brace (wall panel) panel brace is open

Row 3

- Slide 4: Detail of index plate connection with panel brace (wall panel) panel brace is closed

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